Old and Large Douglas-fir and Western Redcedar in the Squamish Forest District, British Columbia, Canada

Report to:
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by

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ABSTRACT

A stand of old and large Douglas-fir (*Pseudotsuga menziesii* (Mirbel) Franco) variety *menziesii* in the upper Elaho River valley, Squamish Forest District, British Columbia, Canada has trees that are estimated to be over 1000 years old, with the oldest trees perhaps having attained an age of 1300 years. Many of the trees have diameters of almost 200 cm. The trees of this stand are among the oldest living Douglas-fir known. The stand is reported to contain over 40 such old and large trees. It occupies approximately 8 hectares of Tree Farm License 38 which is held by International Forest Products. A number of other sites that were thought to have old and large Douglas-fir and Western Redcedar (*Thuja plicata* D. Donn) were examined in 1999 in the Squamish Forest District. Many of the areas visited or viewed from the air had only a few large trees remaining with post-logging, immature forest or tree plantations surrounding or intermixed with them. Other areas had remnant patches of old trees which were surrounded by immature forest and tree plantations. The sites with patches of old trees were typically heterogeneous due to rock outcrops. Old and large Douglas-fir trees that were around 1000 years old and had characteristics of those of the upper Elaho area, were only found in Clendinning Park which is adjacent to it and a remnant patch in the upper Squamish River area. It was found that the upper Elaho site is much more homogenous than the area in Clendinning Park and the upper Squamish River. Also, the density of the old and large trees is unmatched in the other areas that were examined or viewed. The area of old and large Douglas-fir in the upper Elaho River valley presents a rare and splendid opportunity to carry out ecosystem-scale research on this type of temperate rainforest.

If this area is to be managed for research and conservation it will be necessary to substantially reduce the extent of the Douglas-fir Loop Trail, decommission the road near the area and provide a buffer around the area that contains the concentrations of old and large Douglas-fir.

Few old and large Western Redcedar were found in the survey. Additional work to identify ecosystems with old and large Douglas-fir and Western Redcedar in the Squamish Forest District will be an essential component of a progam to maintain biodiversity in the area.

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1 INTRODUCTION

Along the 100 Lakes Trail, where it winds through the Elaho valley between Lava and Cesna creeks, members of the Western Canada Wilderness Committee (WCWC) discovered a stand of old and large Douglas-fir (Fd) -- see Appendix 3 for scientific names. The Douglas-fir of this stand were reported to be approximately 1300 years old, which is near the upper age limit of the species. Members of WCWC marked a route, referred to by the WCWC as, the Douglas-fir Loop Trail -- through this stand. They also set up a research camp near the stand and began a project to document the extent and characteristics of its large and old Douglas-fir. Old and large Western Redcedar (referred to simply as "Redcedar" in this report and abbreviated "Cw") were also reported to grow in the area. Claims were made that the area of these trees was exceptional and should not be logged[1].

To determine if the claims of uniqueness were correct, Paul Kuster, the district manager of the Squamish Forest District asked staff to list (Appendix 1) and map a number of other areas in the district which contained old and large Douglas-fir and Redcedar. He then asked the Research Ecologist of the Vancouver Forest Region to do the following:

- determine if the trees at the Douglas-fir Loop Trail were actually 1300 years old, describe them and take photographs;
- for the trees in the areas listed by forest district staff, and similar trees elsewhere, determine their ages, diameters at breast height and condition and whether or not they were representative of the trees at the Douglas-fir Loop Trail and take photographs.

This report addresses these tasks.

An additional request by the District Manger to investigate a report by WCWC of western wahoo in the area near the Douglas-fir Loop Trail, was completed in another report[2].

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[1] Western Canada Wilderness Committee. 1999. Millennial Tree Camp launched. Rare Western Wahoo discovered in area WCWC steps up campaign to save Stoltmann Wilderness. Vancouver, Western Canada Wilderness Committee, press release. http://www.wildernesscommittee.org/stoltmann/index.html.

[2] Nuszdorfer, F. 1999. Western Wahoo (*Euonymus occidentalis* Nuttall ex Torrey) in British Columbia. British Columbia Forest Service, Research Program. Report. 9 pp.

2 METHODS

At the beginning of the project a reconnaissance of the upper Elaho area was carried out. In it old and large Douglas-fir trees along the Douglas-fir Loop Trail were examined and notes were made about the site series (ecological classes) and common plant species that were present.

Of the 21 areas of large Douglas-fir and Redcedar provided by staff of the Squamish Forest District, 11 were sampled (Figure 1). Also, 2 additional areas were viewed and photographed from the air but not sampled. This required all the available funds and more than the time allocated to complete the project. At some of the areas 2 plots were completed to provide replication or to describe site variability. The area of the Douglas-fir Loop Trail was also sampled.

In addition, it was necessary to sample areas in the vicinity of the Douglas-fir Loop Trail and the stand of Douglas-fir at 46 mile of the Squamish valley which contained stumps of old and large Douglas-fir. This was done to obtain accurate ages of tree stumps that are thought to be similar in age to those remaining in the adjacent stands since the coring method, described later, could not be used for trees that were so large.

The primary focus in this project was on old and large Douglas-fir. Redcedar was also sampled but less intensively.

2.1 Document Old Trees

2.1.1 Location of Plots

All plots were located on aerial photographs, most in colour at 1:20,000 scale. Coordinates in two dimensions were identified as outlined in the Describing Terrestrial Ecosystems Manual (Anonymous, 1998) using a gridded overlay. Many plots were located using a Garmin 12XL® GPS unit. An external antenna was used to improve the data gathering. Even with the external antenna, not all plots could be located because the signal from sufficient satellites could not be acquired by the unit, due to dense canopy cover. The averaging feature of the GPS unit was used to correct for some of the variation in the transmitted satellite data. Coordinates were checked against an estimated location of the plot on digital, forest cover maps. All work was done using North American Datum 83 and the Universal Transverse Mercator coordinate system. Elevations of locations were determined using a Thommen® altimeter which was reset daily at sea level or to a known elevation.

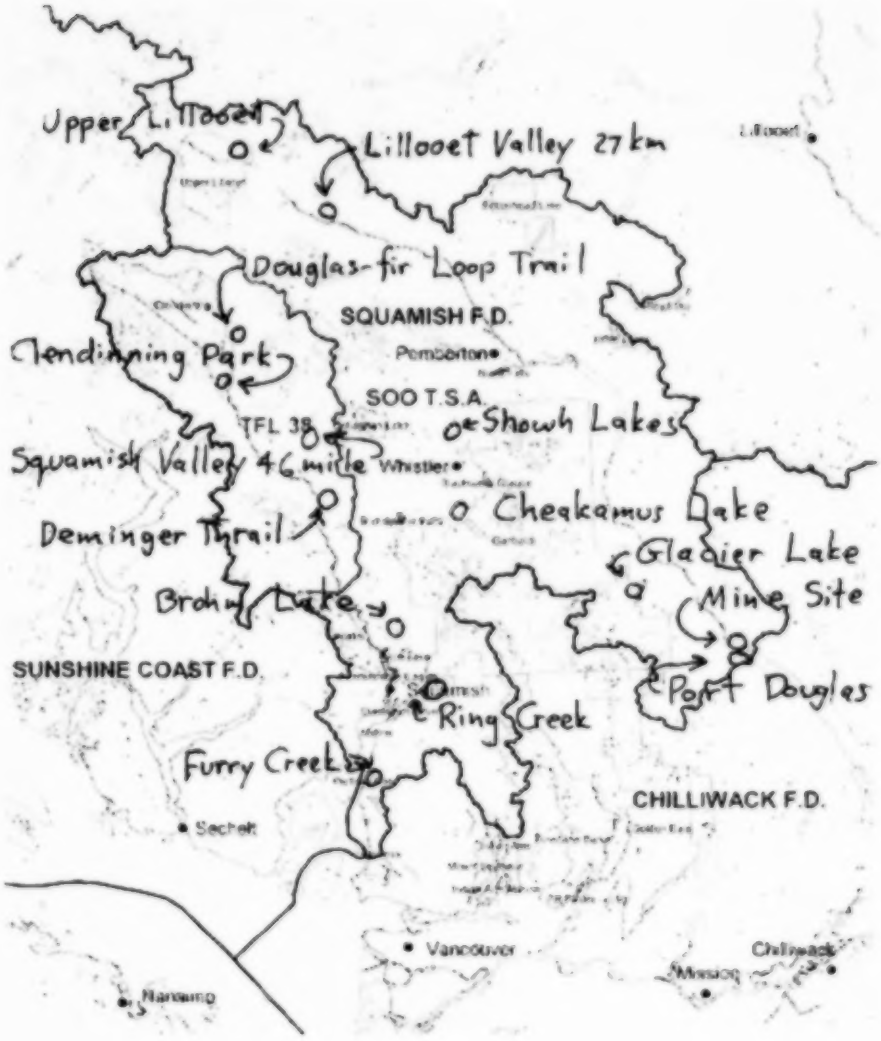

Figure 1. Location of samples of areas reported to contain old and large Douglas-fir and Redcedar in the Squamish Forest District, British Columbia. Approximate scale is 1:1million or 1cm per 10 km.

2.1.2 Tree Ages

Tree ages were determined or estimated using the following methods:

1. For standing trees -- a Suunto® 45cm (17.7inch) or 79.5 cm (31.25 inch) corer. The shorter auger was inserted by hand. In a few cases the longer auger was also inserted by hand using the handle, but more commonly it was inserted using a power borer. The power borer consisted of a Still® 066 chain saw connected via a shortened chain, through a sprocket, to a customized reduction gear. Those cores that were intact when extracted from the auger were counted at the site. Cores that were not sound were immediately placed into plastic tubes as they were extracted from the corer, to avoid loss of any pieces and to maintain their sequence, and labeled. Before the fractured samples could be counted they had to be reconstructed. This was done by mounting them on a piece of dimension lumber which was 1.9 by 1.9 mm square and by the length of the core plus a 2cm edge. The core was glued, using carpenters glue, into a U-shaped cut, that had been made along one side of this piece using a shaping tool. All pieces were mounted with the long axis of the cells facing upward as described by (Stokes and Smiley, 1968).

2. For stumps or logs – (alternative methods were tested to obtain the sample but the following method, suggested by Kevin Hardy, was best):

> A 12cm wide by 150cm long (maximum predicted section size) piece of 13mm plywood was placed on the surface of the stump over the section that was to be sampled. The area of the stump that the plywood covered was outlined with a felt marker. Mono® polyurethane foam was sprayed over the stump area which was enclosed by the lines from the felt marker. With a battery operated screw-gun the plywood was then loosely attached at 35cm intervals to the stump using 2.5cm wood screws. After waiting for ½ hour for the foam to set, two parallel cuts that intersected in a "V" below the plywood and one transverse cut beyond the inside end of the plywood was made into the stump with a Husqvarna® 266XP chain saw with a 20 inch bar and a standard chain. This provided a triangular piece (20 cm on each side) that extended from the bark to a short distance beyond the location on the stump where growth started. The sections were wrapped with plastic stretch wrap and transported to the laboratory.

Sections of stump were further prepared by flattening uneven surfaces of the sections with the chainsaw. This was followed by mounting plywood on the remaining two sides of the triangular section using the Mono® glue and screws. After the glue had set the screws were removed. The sections were then cut into 4cm thick slabs, perpendicular to the stump face. This was done on a table saw with a 30 cm crosscut blade.

3. Ages of the sections were measured using a 15-power hand lens or binocular microscope, set at 10 power.

4. For stumps or logs where the process in step 2 was not possible due to time constraints, or the surface of the stump was too irregular to sample and the bar on the chainsaw was too short to permit cleaning of the stump surface,-- ages were determined in the field. To do this the stump surfaces were first cleaned using a knife. Annual rings were then counted from the bark towards the pith, sometimes with the aid of a 10-power hand lens. Marks were made on the stump for every 50 or 100 year interval.Tree age data and the growth increment per 50 or 100-year period were recorded. Three of the four stumps sampled were also counted in the field. This was to determine if the tree was old enough to warrant the extra effort of obtaining a sample. Also, it was done to provide data in the event that the sample was lost or damaged to the point where it could not be counted.

No corrections were made from the sample height to the germination point since this would have made a minor difference to the ages.

2.1.3 Tree mensurational data

Tree data collected included diameter, height, height to first live branch, height of dead top (if present), diameter of break at top (estimated), degree of lean, condition of wood (if cored). For a few trees at the Douglas-fir Loop Trail, crown width was estimated.

Diameter was measured with a steel tape (calibrated to be read directly in metric units of diameter) at breast height (1.3 m) from the base of the tree if it was on more-or-less level ground, or the high side of the bole, if the tree grew on a steep slope. Due to the large diameters of some of the trees sampled, and the presence of a debris cone around their bases, it was not possible to measure their diameter at 1.3 m above the germination point of the tree which is the usual mensurational technique for smaller trees.

Height data were mostly collected using a Suunto[R][1] clinometer and Eslon[R] 50 metre, fiberglass tape. The heights were calculated using a hand calculator. In a few plots (3) heights were measured using a Digital Hypsometer (Forester Vertex, made by Forester Instrument AB Sweden). This unit made distance measures to the tree sonically and provided a digital display of heights without additional calculation. A complete pathological survey was not done for the old trees since these data were not needed for this project.

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[1] The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the British Columbia Forest Service of any product or service to the exclusion of others that may also be suitable.

Stumps were measured using a metric tape by averaging 2 perpendicular diameter measurements. Most stumps had been cut at a height of approximately 30 cm from the ground level.

2.1.4 Site series and seral stage

To identify and characterize stands ecologically, i.e. to determine the identity of the ecosystems they represented, standard vegetation and site data were collected for a plot that included the large old tree or stump. Plots were approximately 20 by 20 meters. The Ground Inspection Form (1998 form for Terrestrial Ecosystem Mapping) was used to collect the data except for one plot at the Douglas-fir Loop Trail which used the much more comprehensive data form (Number 882). Methods of site description followed the Describing Terrestrial Ecosystems manual (Anonymous, 1998). Site series were based on (Green and Klinka, 1994); site modifiers are from the RIC standard for terrestrial ecosystem mapping (Resources Inventory Committee, 1998); terrain units are based on (Howes and Kenk, 1988).

2.1.5 Photos

For the areas sampled photographs were made that included various views, e.g.:

- Close up of bark and bole
- Upward to crown
- General site characteristics
- Forest Floor
- Distance or aerial

Kodak print film with speeds of 200 or 400 ASA were used in a Pentax K1000 and a 50 mm macro lens or Pentax PZ-1 with a 28-80 mm zoom lens. In many forest photographs the flash that was built into the PZ-1 was used. A tripod was used for some photographs.

3 RESULTS AND DISCUSSION

This section is organized according to three administrative components in the Squamish Forest District:

- Tree Farm License (TFL) 38
- Soo Timber Supply Area (Soo TSA), Private Land, Excluding Parks
- Parks

Following these sections the age and mensurational data are summarized for the Squamish Forest District. The locations of these components are illustrated in Figure 1.

TFL 38 is confined to the upper Squamish River and the entire Elaho River and Ashlu Creek watersheds. This area is licensed by the Crown to International Forest Products Ltd. The Clendinning River also flows into the Elaho River but is included under the parks section.

The Soo Timber Supply Area covers the remaining area of the Squamish Forest District. In it forests are managed for timber production (an allowable annual cut is set, similarly as for TFL 38) and other resource values.

The parks that were sampled include Garibaldi Park, Upper Lillooet Park and, recently proclaimed, Clendinning Park. The parks are administered by Ministry of Environment, Land and Parks (MELP).

3.1 TFL 38

Two plots were sampled along the Douglas-fir Loop Trail. In addition, 5 other areas with old and large Douglas-fir and Redcedar were located in the TFL by Forest Service staff. Of these 5 areas, only the Deminger Trail and two subareas, one for Redcedar and one for Douglas-fir, at 46 mile along the Squamish Main logging road in the Squamish Valley, were sampled. The Elaho Giant, located along a recreation trail, was only viewed and photographed because there was insufficient time to sample. Again because of lack of time, neither samples nor observations were possible for sites identified as "Grizzly Grove" and "Squamish Valley West Side".

3.1.1 Deminger Trail

Deminger Trail was identified for both Douglas-fir and Redcedar. The trees along the trail are estimated to be 329-333 years old based on the data in Table 1, and a correction to year 1999. It was not necessary to core a tree to obtain an age at this location because several trees had been cut

Table 1. Ages and diameters of stumps at Deminger Trail, Squamish Valley, British Columbia

Species	Age (years)	Stump Diameter (cm)	Cut (year)
Douglas-fir	314	178	1980-83
Douglas-fir	313	63	1980-83
Redcedar	310	153	1980-83

for bridge stringers and the annual growth rings in the stumps were easy to count. The stand here probably originated after a fire. This is assumed because of: 1) the limited age variation despite a range in diameters of trees 2) a relatively narrow and homogeneous crown layer, and 3) the presence of charcoal in the soil profile. No trees were seen that appeared to be older than the trees that were sampled, i.e. that survived the fire.

The tallest Douglas-fir that was measured in the plot along the Deminger trail was 74 m with a diameter of 164 cm (Figure 2). Another tree with a diameter of 168 cm was 55 m tall. Most of the trees in the plot had intact tops and displayed good vigor.

Deminger Trail is in the Southern Dry Submaritime Coastal Western Hemlock variant (CWHds1) and the Eastern Pacific Ranges Ecosection. The plot is on the Cw – Solomon's-seal site series in an old forest structural stage. Normally, a site such as the one Deminger Trail occupies, in a lower-slope position, has a soil moisture regime (SMR) of 5 or 6. In this case the SMR is 4, due to the well-drained, high coarse-fragment-content and sandy soil of the fluvial fan of Terminal Creek, on which the trail is located. The soil nutrient regime (SNR) is rich as a result of the soil organic matter enrichment by the fluvial action and the great depth of soil that is available for rooting of trees.

Western hemlock is another major tree species of this site. A minor amount of Bigleaf Maple is also present. Red Huckleberry is the major shrub while the herb layer is dominated by Twinflower, Hooker's Fairybells, Bunchberry, and One-leaved Foamflower. The rich site indicator species – *Plagiomnium insigne* is the most common moss species. Other major species include *Kindbergia oregana*, *Rhytidiadelphus loreus*, *Mium spinulosum*, and *Hylocomium splendens*.

The Deminger Trail has been approved by the District Manager under Section 102 of the *Forest Practices Code of British Columbia Act (FPC)* (trail number 6326). At this time the trail is a map notation which is a BC Forest Service internal designation. In the future this trail may be

Figure 2. Photograph of large Douglas-fir boles at the Deminger Trail site, TFL 38, British Columbia.

designated as interpretive forest sites or provided with some other reserve status under the *FPC Section 6(1)*.

Only the trail with a narrow buffer is reserved from logging. Partly the trail follows a logging road which is above the area. It originates from a parking lot which is adjacent to the Squamish Main logging road. The area immediately beside the trail is original forest. The areas beyond this patch of original forest have recently been clearcut or cutting is planned according to the Management Plan for the TFL, i.e within 5 years – the term of the plan. The area in the immediate vicinity of the trail is not identified for cutting in the Management Plan but it is not identified as a reserve either.

The area of interior forest that will be present at this site will depend on whether the area immediately around it is eventually cut or not. Even if the area around the trail is not cut, the area of interior forest will be small. The effect on interior forest could be partly mitigated by planning cuts around the trail so that one side is forested before the other is cut. However, with roads above and below the area, this mitigation could only be lateral.

The Deminger Trail area has important recreational and eductional value. However, because of the location of the Deminger Trail within a plantation forest matrix, the dense road network in the area, and the need to cut trees that die to avoid a danger to visitors, this site has limited value for conservation of original forest structure and dynamics.

3.1.2 Douglas-fir Loop Trail

Old and large Douglas-fir are a prominent feature of the Douglas-fir Loop Trail. However, it was not possible to obtain ages from the trees along the trail. The core, reported to show that the tree from which it was taken was 1300 years old, was not available for viewing during the sampling period since it was being used for media presentations by WCWC. Several requests to view the core were made, without success.

The increment corer that was available shortly after the start of field work was 79.5 cm long. Allowing for 10 cm of space between the end of the corer and the tree bark for extraction, the largest diameter-tree that could be sampled was around 140 cm. This was smaller than the trees at the Douglas-fir Loop Trail. Thus, it was not possible to confirm or refute the reported age of the trees along this trail using direct methods.

Instead of direct sampling to obtain ages of the Douglas-fir at the site of the trail an indirect approach was taken. The premise underlying the approach is that Douglas-fir usually originates after a major disturbance, often wildfire. If Douglas-fir with similar characteristics was present in a contiguous geographic area and the area is known to have a history of periodic stand-replacing wildfire, it has often been found, allowing for minor variation in establishment times, that the trees were similar in age. (Were, because this has usually been determined after the trees are cut making accurate aging and compehensive sampling possible). It was observed, during trips to the area of the Douglas-fir Loop Trail, that Douglas-fir trees with similar characteristics to those at the trail occurred in proximate areas that had been recently logged.

Two areas with stumps, logs on the ground, and standing trees at the edges were sampled. One of these areas is immediately south of Lava Creek the other is slightly further south at an area referred to as "Retention Cut". As noted earlier, Lava Creek is near the southern boundary of the old and large trees at the Douglas-fir Loop Trail. The retention cut area is at 60 mile of the Elaho Main, which is approximately 8 km south of the Douglas-fir Loop Trail area.

Several stumps of Douglas-fir trees that are thought to be similar to those still standing at the Douglas-fir Loop Trail were sampled and counted during this project (Figure 3). With the exception of 1 tree which was forked at the base, ages of the stumps were around 1000 years old (Table 2). The site series of the areas of cut stumps were the same as the site series of the samples taken along the Douglas-fir Loop Trail or were a site

Figure 3. Stump of old and large Douglas-fir in the "Retention Cut" area of the upper Elaho River valley, Squamish Forest District, British Columbia

series with a SMR of 2, i.e. drier-than-zonal (FdPl – Kinnikinnick). Thus, it is very likely that the Douglas-fir at the Douglas-fir Loop Trail are this old. It is also possible that some of the trees are older than this, originating from an earlier stand-replacing wildfire.

The trees along the Douglas-fir Loop Trail in sample plots were 193 and 186 cm in diameter with heights of 41 and 38 m, respectively. These trees are typical of those present in the stand. Several distinguishing characteristics of the trees of the stand include:

Table 2 Ages of stumps of Douglas-fir near the Douglas-fir Loop Trail, Squamish Forest District, British Columbia.

Area	Species	Age (years)	Stump Diameter (cm)	Site Series	Cut (year)
Lava Creek	Fd	1012	206	HwBa - Step Moss	1999
	Fd	558	182	HwBa - Step Moss	
	Fd	1096*	242	FdPl – Kinnikinnick	
Retention Cut	Fd	1030	216	HwBa - Step Moss	1998
	Fd	997	159	HwBa - Step Moss	

*estimated due to 68 cm diameter rotten centre (count=975)

- very deeply furrowed bark (Figure 4)
- a truncated stem giving the boles of the trees the appearance of erect pipes (Figure 5)

- a crown only near the top of the truncated stem with a lower bole that is more-or-less clear of branches
- multiple tops from lateral branches in some individuals

Stumps of trees sampled to estimate ages and others encountered indicate little rot, which is unusal for trees of this age. Most of the stumps and timber seen had ring-shake.

The Douglas-fir Loop Trail site is in the Southern Moist Submaritime CWH variant (CWHms1) and the Eastern Pacific Ranges Ecosection. Two plots were sampled in the area with both representing the HwBa – Step Moss site series in an old forest structural stage. This is the zonal site series for the CWHms1. The SMR is 4 and the SNR ranges between poor and medium.

Although some of the old and large Douglas-fir in the Douglas-fir Loop Trail area have died and some have since fallen to become coarse material on the ground, many are still vigorous. Since most of the stumps that have been seen show little or no signs of rot, indications are that these trees

Figure 4 Photograph of deeply furrowed bark of old and large Douglas-fir at the Douglas-fir Loop Trail, upper Elaho River valley, British Columbia.

Figure 5. Photograph of broken top of old and large Douglas-fir at the Douglas-fir Loop Trail, upper Elaho River valley, British Columbia.

could still live for many hundreds of years. Old and large Douglas-fir at the edge of the clearcut south of Lava Creek, which burned recently, appear to have survived the fire (Figure 6).

The Douglas-fir in the Douglas-fir Loop Trail are not regenerating under the canopy. The regeneration is dominated by Redcedar, Yellow-cedar and Western Hemlock. Unless this area is logged, or larger gaps are created in this canopy by natural events such as windthrow, and mineral soil is exposed as a germination medium, or seedlings are planted, regeneration of Douglas-fir is not expected to occur or to be achieved.

Other tree species, including Western Hemlock, Amabilis Fir, Yellow-cedar and Redcedar, grow in this area as well but they are generally not as large as the Douglas-fir. The well represented shrub layer is dominated by the ericaceous species such as Alaskan Blueberry, Black Huckleberry and False Azalea. Sitka Alder is also present in this layer. The predominance of Yellow-cedar and the presence of Sitka Alder along with the ericaceous shrubs, listed earlier, indicates cooler and moister monane conditions. Occasional Subalpine Fir in open areas near the gorges of the streams and

Figure 6. Photograph of charred but still living Douglas-fir after a fire, Lava Creek, upper Elaho River valley, British Columbia.

river indicate submaritime and subalpine conditions. Mountain Hemlock in these locations also indicates subalpine conditions.

The herb layer is generally sparse in the plots with Bunchberry leading in cover. In contrast to the herb layer, there is a high cover of mosses with *Pleurozium schreberi* and *Rhytidiopsis robusta* as major species.

The Douglas-fir Loop Trail is not approved under Section 102 of the FPC and is not indicated as a map notation. Discussions are continuing between the Squamish Forest District manager and Interfor regarding the status of the area of this trail.

The lower elevational boundary of the stand of trees at the site of the Douglas-fir Loop Trail is the deep gorge of the Elaho River. The downstream boundary is the deep gorge of Lava Creek and the upstream boundary is the deep gorge of Cesna Creek. Above the stand is a younger stand of trees, which includes Douglas-fir (one tree was 370 years old

when cut). The younger stand is scheduled for clearcut logging this year. The largest trees are generally away from the natural edges. This provides a natural windfirm, forest buffer for the old and large Douglas-fir. Proposed logging at the upper edge of the area with old and large Douglas-fir will have an adverse effect on forest interior conditions and a possible adverse effect on the remaining trees due to the open edge which may lead to windthrow of remaining trees.

No roads are in the stand but the logging road to the younger trees above it is near the area of the Douglas-fir Loop Trail. One spur was cut in anticipation of road construction approval into the stand of old and large Douglas-fir. This spur ends in close proximity to the old and large Douglas-fir stand. The area on the downstream side of Lava Creek has been clearcut logged but not to the edge of the stream. This provides an additional treed buffer to the trees of the Douglas-fir Loop Trail. Interfor has plans to log the area on the upstream side of Cesna Creek, probably to the Riparian Reserve.

Due to natural buffers created by the stands adjacent to the gorges of Lava and Cesna creeks and the Elaho River, much of the area of old and large trees along the Douglas-fir Loop Trail is interior forest. However, the trail virtually allows a walker to touch many of the old and large Douglas-fir which will eventually cause substantial unnatural disturbance to the vegetation of the area. If logging encroaches on the area of old and large trees the area of interior forest there will be significantly reduced.

If this area is to be managed for research and conservation it will be necessary to substantially reduce the extent of the Douglas-fir Loop Trail, decommission the road near the area and provide a buffer around the area that contains the concentration of old and large Douglas-fir.

3.1.3 Elaho Giant Trail

Not far from the location of the Douglas-fir Loop Trail, in an area that has been mostly logged, is a small patch of trees that includes an old and large Douglas-fir. The tree that has been left standing is within the broader area that is thought to have been regenerated at the same time as the Douglas-fir at the site of the Douglas-fir Loop Trail. The tree has many similar characteristics as those of the Douglas-fir Loop Trail, including the truncated stem. However it is larger in diameter – 270cm (Figure 7). Its height is reported to be 47.5 m. Based on the tree characteristics the Elaho Giant is estimated to be over 1000 years old. However, it is not possible to say whether its age is similar to that of the cut stumps or whether it is older.

The Elaho Giant is in the CWHms1 and the Eastern Pacific Ranges Ecosection. It is at an elevation of 600 m. A site assessment was not done so the site can not be identified.

The Douglas-fir of the patch along the Elaho Giant Trail is accompanied by Western Hemlock, Redcedar, and Yellow-cedar in the tree layer. Amabilis Fir is present as regeneration. The major shrubs near the old and large Douglas-fir are Oval-leaved Blueberry and False Azalea. Mosses at this location were not identified.

Elaho Giant Trail (number 6358) has been approved by the District Manager under Section 102 of the FPC. The trail is a map notation. In the future it may be designated as an interpretive forest site or provided with some other reserve status under the FPC.

The recreation trail is adjacent to the tree. The area is a small patch surrounded by clearcut. Roads are above and below the tree. The area of

Figure 7. Photograph of the bole of the Elaho Giant, upper Elaho River valley, British Columbia.

this trail has recreational and educational value. Conservation value of the area is limited since it could be considered only as a small wildlife tree patch. There is no interior forest condition in the patch.

3.1.4 Grizzly Grove

Interfor logged a block that contained an area referred to by WCWC as the "Grizzly Grove" in 1998. The stand at Grizzly Grove had been identified by WCWC for its exceptional conservation values in documents related to the proposed Randy Stoltmann protected area.

Twelve hectares of wildlife tree patches have been retained on this block.

This was the only site selected exclusively for Redcedar by Squamish Forest District staff. Reportedly there is a wildlife tree patch remaining within the area that has been cut which contains old and large Redcedar. . The wildlife tree patches at "Grizzly Grove" were not sampled or viewed.

This site would warrant additional attention if there were to be a subsequent effort to determine the ages of Redcedar in the area, since a number of fresh stumps would be available for age determination. However, in contrast to the situation with Douglas-fir, stand ages and ages of still standing trees could not be estimated because Redcedar is able to regenerate in the understorey of a stand whenever suitable conditions exist. Also, due to the common occurrences of heart rot in Redcedar, it would still be difficult to obtain complete ages of trees.

By its geographic location, the area of the "Grizzly Grove" is probably in the CWHms1. Is is within the Eastern Pacific Ranges Ecosection.

3.1.5 Squamish Valley 46 Mile

Redcedar

One of the largest known Redcedar remaining in TFL 38 was located in the Squamish River valley near the 46 mile marker along the logging road. Interfor cut it as part of a clearcut in 1995. The stump of this Redcedar is 381cm in diameter (Figure 8). No Redcedar trees with this large a diameter were seen during field sampling. This large size of tree is unusual in submaritime areas, so it will likely be difficult to find similarly large trees elsewhere in the Squamish Forest District.

The age of the old and large Redcedar at this area could not be determined because a substantial part of the centre (215 cm diameter rot) was rotten. The outer shell was 400 years old when the tree was cut. However, a relatively rot-free (only 22 cm diameter rot), smaller (stump diameter = 140 cm) Redcedar that was near the large one, but on a drier and nutrient-medium microsite, is estimated to have been around 900 years old when it was cut (counted 844 years and estimated 56 years for rotton centre). It is

Figure 8. Photograph of stump of large Redcedar, upper Squamish River valley, British Columbia.

quite possible that the larger Redcedar was this old when it was cut, or older. The dramatic difference in tree stump sizes can be ascribed to the differences in SMR and SNR among the sites on which they grew.

The site of the large Redcedar stump is in the CWHms1 and the Eastern Pacific Ranges Ecosection. The site series is BaCw – Devil's Club. The SMR is 6, SNR is rich. The area is in the forb-dominated shrub/herb structural stage. Fireweed is the major species of the area.

Alongside Rendell Creek stands an old and large Redcedar. The location and lean of the tree precluded cutting during recent logging, since there was a chance that it would enter the stream if this was done. At this location Rendell Creek is too steep to bear fish, however, within a short distance it flows into the Squamish River, which does. Thus, the tree was not cut.

The height of the Redcedar was 52 m (including a 11 m dead spike-top) and it had a diameter of 237 cm. It is forked near the base. Allowing for some difference between the stump diameter and breast height diameter, this tree is still considerably smaller in diameter than the 381 cm Redcedar stump that is described earlier in this section.

The biogeoclimatic unit, ecosection and site series are the same as described earlier for the large Redcedar stump. The SMR is 5, not 6, while the SNR is the same – D. The site modifier for this area is coarse due to the sandy gravel soil.

The tree is located near the creek so it is at a natural edge (Figure 9). A short distance above the tree is another edge created by a logging road. Also, the stand of trees is open due to a natural opening. Clearcuts are upstream and downstream of the strip of trees that remain along Rendell Creek. A stand of Douglas-fir above the road is planned for future logging according to the MP of Interfor. The narrowness of the reserve area and the surrounding matrix of plantation forest means it has conservation value only as a wildlife tree patch. There is no interior forest in the patch.

Douglas-fir

Alongside Rendell Creek, the steep stream that flows into the Squamish River, stand a few old and large Douglas-fir. This group of trees is immediately adjacent to the site of the Redcedar described in the previous section.

The height of one of the larger trees of the group was 56 m and it had a diameter of 202 cm. Another tree in the group, whose height was not measured, had a diameter of 161 cm.

A 222 cm diameter stump in a 1995 clearcut, near the area with standing Douglas-fir, was estimated to be 991 years old. An exact age was not possible because of a small amount of rot at the centre of the stump. The tree was cut in 1995. It is reasonable to assume that the trees still standing beside Rendell Creek have a similar age.

The site is in the CWHms1 and Eastern Pacific Ranges Ecosection. A site identification of the area containing the Douglas-fir was not done. However, it is different from the nearby site that contains the old Redcedar.

The standing trees of this area are not protected in a riparian reserve under the FPC because the stream does not bear fish. No other reserve status for the area has been proposed by the Britsh Columbia Forest Service (BCFS) or Interfor.

For the same reasons described in the previous section about the Redcedar at this site, the Douglas-fir trees remaining here provide wildlife tree habitat. The area is entirely affected by forest edge (Figure 10).

An area above the road has not been logged but logging is planned. This area appears to contain trees that have characteristics similar to those of

Figure 9. Photograph of Redcedar at edge of gully of Rendell Creek, upper Squamish River valley.

Figure 10. Photograph of small patch of old and large Douglas-fir at Rendell Creek, surrounded by clearcuts, in the upper Squamish River valley, British Columbia.

the old and large Douglas-fir below the road and those in the Elaho River valley. It is recommended that this area be examined to verify the presence

of these old and large Douglas-fir and, if they are confirmed, to reserve them from cutting, preferably entirely in an intact stand, but at least as individual wildlife trees.

3.2 Soo Timber Supply Area (Soo TSA) and Private Land

Eleven areas with old and large Douglas-fir and Redcedar were located in the Soo TSA and on private land by Forest Service staff. Of these, the site at Ring Creek was only viewed and photographed from a helicopter. Six other areas were sampled in detail. At Brohm Lake two plots were established because of its high degree of heterogeneity and its relatively large extent. Two plots were sampled in the lower Lillooet River valley near Port Douglas because both Douglas-fir and Redcedar were there.

3.2.1 Brohm Lake

A remnant of the original Douglas-fir forests north of Squamish has been identified as a recreation trail/site (Brohm Interpretive Forest) by the BCFS. The site and trail are a map notation (a BCFS internal designation). In the future they may be provided with some other reserve status under the FPC. The area was identified for its old and large Douglas-fir by BCFS staff.

A combination of counts of cut Douglas-fir stumps and increment coring were used at this site. Ages thus estimated were from 300 to 400 years. Two of the largest trees, near the edge of Brohm Lake, could not be aged due to their large diameters (Figure 11). By their size, deeply furrowed bark, large branches in the crown and flattened, but live, tops it is possible that they are older than 400 years. However, due to the relatively productive microsite on which they are growing and the typical growth rate of other Douglas-fir on such sites, it is not likely that they are more than 700 years old.

The sampled trees ranged in diameter from 106 cm (Figure 12) to 175 cm. The latter was for the larger of the two trees along the lake, described previously. The 106 cm-diameter tree was 39 m tall while the 175 cm-diameter tree was 59 m tall.The Brohm Lake site is in the CWHdm and the Southern Pacific Ranges Ecosection. Two site series were sampled: FdHw – Salal, associated with the 106 cm diameter Douglas-fir, and HwCw – Deer Fern, associated with a site near the edge of Brohm Lake which had a 129 cm-diameter, 61 m-tall Douglas-fir (north of the location of the 175 cm Douglas-fir). The FdHw – Salal site association is common

Figure 11. Photograph of old and large Douglas-fir near the edge of Brohm Lake, British Columbia

in the areas with outcropping bedrock in middle and upper-slope locations. The HwCw – Deer Fern is only present in a few lower-slope locations, typically near Brohm Lake. Other site series are present in the area but were not sampled.

Douglas-fir dominates the tree layer in the plot representing the FdHw – Salal site series. Bigleaf Maple was also present in this layer. Redcedar and Salal had the greatest cover in the shrub layer. Mosses with the greatest cover on humus were *Kindbergia oregana* and *Hylocomium splendens*. Mosses on rock were mostly *Isothecium stoloniferum*.

Douglas-fir also dominates the tree layer in the plot representing the HwCw – Deer Fern site series but Redcedar and Western Hemlock are

Figure 12. Photograph of old Douglas-fir at the edge of a plantation forest at Brohm Lake, British Columbia

also well represented. The shrub layer and moss layers are very sparsely covered.

The Brohm Lake recreational trail is cut into colluvium close to the root system of the largest Douglas-fir measured in this sample. Local trampling of vegetation, particularly along the lake edge, has occurred where the trail is not confined by natural barriers or where hikers have detoured to a lookout or shoreline spot.

The old and large Douglas-fir is present in a large, irregularly-shaped polygon which extends from Brohm Lake to the west, ending at the road along the Squamish River. Younger forest, dominated by Douglas-fir occurs in the lobes and at the edges of this polygon. Younger Douglas-fir forest also occurs within this polygon, since much of it has been under-

burned, perhaps in 1953[2]. Additional areas that are similar to those at Deminger Trail are also present along rocky slopes and hilltops nearby, e.g. near the BC Hydro right-of-way on the east side of Highway 99, the Sea-to-Sky Highway.

There is considerable forest edge in this area because of the irregular shape of the area of old and large Douglas-fir and the fact that Douglas-fir regeneration is still not tall (e.g. see the foreground in Figure 12). The roads at the east and west boundaries of the patch and the BC Hydro right-of-way at the east boundary (not the same one as east of Highway 99) also create edges. An unknown amount of area at this site may qualify as interior forest. The value for conservation for some wildlife will be reduced in this area because of the extensive trail system and its heavy use by hikers and mountain bikers. In much of the recreation area truck and car traffic, much of which is making its way to and from Whistler, can be heard, making a wilderness experience impossible.

The proximity to Squamish and Greater Vancouver and the presence of the lake make this area very important for non-wilderness recreation. It also represents a wildlife tree patch and contains wetlands (albeit the largest is compromised by highway fill on one side). However, this area is not at all comparable, from an individual tree or a site perspective, to the stands of old and large Douglas-fir in the Elaho and Upper Squamish River valleys.

3.2.2 Furry Creek

This area was identified for remnant old and large Douglas-fir by BCFS staff. Tanac Land Development Corporation holds the fee simple title (commonly referred to as "private land") to the area on which the large trees were sampled.

Cut stumps are present near the sampled tree. It was probably not logged in the first pass due to the presence of rot and steep slopes. A few large Douglas-fir also remain on steep slopes above Furry Creek, near the location of the sampled tree. The matrix in which these trees remain is young forest, probably regenerated naturally after logging.

The Douglas-fir that was sampled is 67 m tall and its diameter is 210 cm (Figure 13). The tree had an intact, but dead, top (Figure 14). This distinguishes it from the old and large Douglas-fir of the Elaho and Upper Squamish River valleys, described in earier sections, whose tops had

[2] Brohm Lake Interpretive Forest, Squamish, B.C., Forest Recreation brochure. Province of B.C. Ministry of Forests, Squamish Forest District, Squamish, B.C.

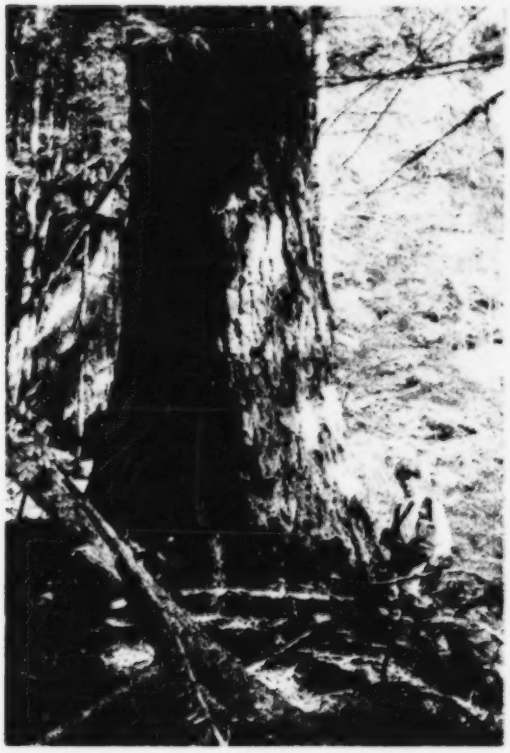

Figure 13. Photograph of bole of old and large Douglas-fir near the edge of Furry Creek, British Columbia.

broken off long ago. Some of the branches of the upper crown of this tree were dead. Another tall Douglas-fir tree upslope of this one was 208 cm in diameter. Its height was not determined.

An increment core was taken from the 210 cm diameter tree since there were no stumps that could be counted in the area. The core taken crumbled into tiny fragments when it was extracted because of the extensive rot inside the tree. Thus, no age estimate for this site was obtained. The dry rot confirms this as one of the reasons that this tree was not cut in earlier logging. (The presence of rot is indicated by a large scar on the side of the tree which would have been present at the time of early logging).

Figure 14. Photograph of old Douglas-fir near the edge of Furry Creek, British Columbia.

The Furry Creek sample was from the Dry Maritime Coastal Western Hemlock subzone (CWHdm). It is in the Southern Pacific Ranges Ecosection. The site series is HwCw – Deer Fern. The SMR of this site is 5 and it has a medium SNR.

Although the tallest tree in the sample was Douglas-fir, Western Hemlock and Redcedar had greater cover. Bigleaf Maple and Red Alder were also important trees on the site. The herb and moss layers were very sparse due to the high density of the tree crowns and heavy litterfall.

The area with the large Douglas-fir is on a small fluvial terrace at the edge of Furry Creek.

The area sampled contained individual trees in a matrix of second growth. Behind the area sampled there is a hillside which includes old Douglas-fir trees.

Furry Creek creates a natural edge for the Douglas-fir at this site. Above the stand is a logging road which forms another edge. Upstream and downstream of the old and large Douglas-fir are immature trees, so there is continuous forest in these directions.

This area represents an important wildlife tree patch but it is not comparable from an individual tree or a site perspective to the stands of old and large Douglas-fir in the Elaho and Upper Squamish River valleys.

3.2.3 Lillooet Valley 27 km

A narrow strip of original forest along the road through the Lillooet valley, north of Pemberton contains old and large Douglas-fir. It is also the site of an excellent wetland. The area was selected for Douglas-fir by BCFS staff.

The area was sampled before the long increment corer was available, so only a short core could be taken. A few stumps were present in a clearcut next to the Lillooet River on a similar site as the one that contained the old and large Douglas-fir, but could not be counted in the field due to a shortage of time on the sampling day and poor condition of the stumps. They could not be sampled subsequently (using a chain saw) due to lack of time and funds to permit a return to the site.

Using the data from the short core (count of 368 years), correcting for missed years beyond the reach of the increment corer, and assuming the trees originated shortly after a major disturbance, the Douglas-fir at this location are estimated to be less than 550 years old.

The Douglas-fir sampled, representing one of the largest trees in the patch, was 49 m tall and had a diameter of 143 cm (Figure 15). It had an intact, live top.

The area at 27 km in the Lillooet River valley is in the CWHds1 and Eastern Pacific Ranges Ecosection. The site series sampled was HwFd – Cat's Tail Moss in old forest structural stage. A site modifier of terraced was applied because the area is on a sandy terrace of the Lillooet River. The SMR of the area is 4 because it is raised well above the level of the river and has a sandy soil texture that is rapidly drained and it has a poor nutrient regime.

Although Douglas-fir is the tallest tree on the site sampled, Western Hemlock and Redcedar dominate the tree canopy. A variety of herbs were

Figure 15. Photograph of the bole of an old Douglas-fir near 27 km of the Lillooet River valley north of Pemberton, British Columbia.

noted in the plot but had low cover. One-leaved Foamflower was the most abundant of these. The moss layer, mainly of *Rhytidiopsis robusta* was well developed.

The strip of trees along the Lillooet River is very narrow, so there is no interior forest. The unlogged area widens at the wetland, again there is a very narrow treed buffer to clearcuts. There is no interior forest here either.

This area represents a wildlife tree patch and wetland in a matrix of plantation forests (Figure 16). It is not at all comparable, from an individual tree or a site perspective, to the stands of old and large Douglas-fir in the Elaho and Upper Squamish River valleys.

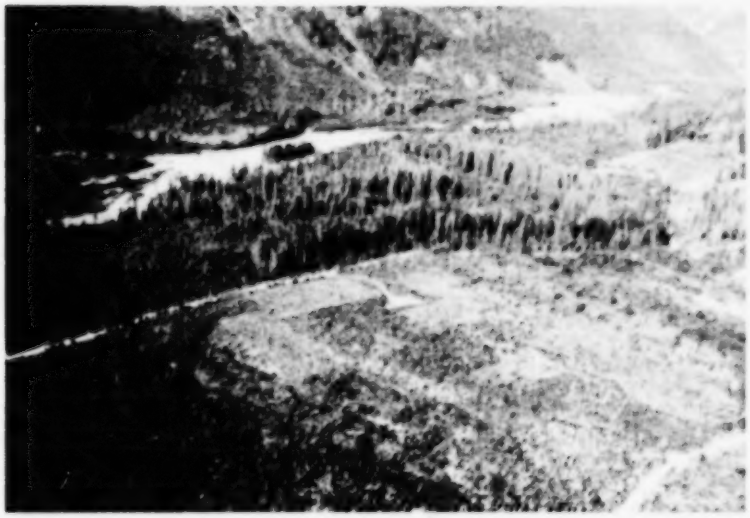

Figure 16. Strip of original forest, dominated by Douglas-fir, at the edge of the Lillooet River and the adjacent wetland, near 27 km in the upper Lillooet River valley, north of Pemberton, British Columbia.

3.3.4 Mine Site

A site that was mistakenly thought to be the location of an area referred to locally as the "Cabbage Patch" (known to BCFS staff for its old and large Douglas-fir) was sampled on the rocky hillside above the lower reaches of the Lillooet River. It is referred to as the Mine Site because there is an active mining claim in the area.

No cut stumps were available for age determination so increment cores were taken from 2 Douglas-fir trees. The tree above the logging road that cut through the area sampled was estimated to be 400 years old (Figure 17). It was 27 m tall. Its diameter was not measured but it is less than the tree below the road.

Another Douglas-fir below the road was 290 years old (Figure 18). It was 41 m tall and had a diameter of 98 cm. Both trees had tops that were flat and had some dead limbs.

This area is in the CWHds1 and the Eastern Pacific Ranges Ecosection. However, the southerly aspect and 59 % slope conspire to create local conditions for the vegetation that is like those of the Wet Warm Interior

Figure 17. Photograph of bole of Douglas-fir at Mine Site in the lower Lillooet River valley, British Columbia.

Douglas-fir Subzone. Under such conditions Douglas-fir can regenerate in small openings, if the canopy cover is dense, or under the canopy in general, if it is not dense. Thus, uneven-aged stands of Douglas-fir can be expected to occur under such conditions. This is an explanation for the differences in Douglas-fir ages found in this patch.

The site series is FdPl – Kinnikinnick with *hummocky* and *warm* site modifiers. It is in an old forest structural stage. The SMR of the site is 2 and it has a poor SNR.

Douglas-fir is the only tree species on this site. It is in the tree layer and also dominates the shrub layer. The herb layer is sparse. In contrast, much of the plot area is covered by moss. The most prominent moss on the site is *Dicranum scoparium*. *Claopodium* sp.(uncertian identification), *Kindbergia oregana*, *Hylocomium splendens*, and *Rhytidiadelphus loreus* are also common on the bedrock-dominated site.

The trees on this site are not protected by a reserve. Often such stands were not logged in the first pass through a watershed because of lower value when compared to other stands and a limit in the amount that could be cut at one time.

Figure 18. Photograph of old Douglas-fir at Mine Site in lower Lillooet River valley, British Columbia.

There is considerable forest edge below this stand where young tree regeneration is growing. The road through the patch of old Douglas-fir trees also creates an edge. An unknown amount of area at this site may qualify as interior forest. However, the application of the concept of interior forest may not be appropriate in the case of this patch, since this area is generally only incompletely covered by tree canopy open due to the presence of open areas among the rock outcrops and colluvium.

This area represents an important wildlife tree patch but it is not comparable from an individual tree or a site perspective to the stands of old and large Douglas-fir in the Elaho and Upper Squamish River valleys.

Douglas-fir with characteristics similar to those found at this site are common in areas that have similar bedrock outcrops in many areas of the CWHds1. It would not be surprising to find that the tree ages at other

locations in the Forest District are comparable to those found at this site, i.e. between 300 and 400 years old.

3.3.5 Port Douglas

An area near the tiny community of Port Douglas, at the head of Harrison Lake, alongside a BC Hydro right-of-way, was identified for Redcedar by BCFS staff. While sampling at the site, a large Douglas-fir was also noted and sampled.

It was not possible to obtain the age of the Redcedar because it was mostly hollow. The Douglas-fir was cored with the large increment corer. The tree was too large for the corer to reach the centre. Including a correction of 14 with the count age of 192, the tree was estimated to be 210 years old.

The Redcedar was 44 m tall and had a diameter of 336 cm. The corresponding figures for the Douglas-fir were 69 m and 163 cm. The Douglas-fir tree had an intact, but dead top. The top 4 m of the Redcedar was dead. It may be a culturally modified tree (CMT), since there is an old wound near the base of the tree, indicating possible harvesting activities long ago.

The Port Douglas sample area is in the CWHds1 and the Eastern Pacific Ranges Ecosection. The two sampled trees were in the same patch, identified as the Cw – Devil's Club site series with an active floodplain site modifier in a mature forest structural stage.

A major tree species at this site, in addition to Douglas-fir and Redcedar, is Bigleaf Maple. Devil's Club and Douglas Maple dominate the shrub layer. The well developed herb layer is dominated by One-leaved Foamflower but has many other species as well. The moderately well developed moss layer includes *Rhytidiadelphus loreus, Rhytidiadelphus triquetrus, Mnium spinulosum* and *Plagiomnium insigne*.

The area was partially cut, perhaps in 1910, since Redcedar stumps were noted in one of the plots.

The patch containing the Redcedar and Douglas-fir is small, surrounded by younger forest on three sides and adjacent to a BC Hydro right-of-way on the fourth (Figure 19). There are backchannels present throughout the area which are probably frequented by fish so some may be in what now would be a riparian reserve zone. Whether this applies to the entire patch or not is not known. With the presence of a more-or-less perpetual open

Figure 19. Photograph of patch of original forest containing old and large Redcedar and Douglas-fir. The matrix is plantation and naturally regenerated forest which grew after clearcut logging in the valley. The patch is near Port Douglas, British Columbia.

area, due to the BC Hydro right-of-way, this patch will have limited or no interior forest. However, it represents an important, small wildlife tree patch in the lower reaches of the Lillooet River valley. On the other hand, it is not at all comparable, from an individual tree or a site perspective, to the stands of old and large Douglas-fir in the Elaho and Upper Squamish River valleys.

3.3.6 Ring Creek

BCFS staff identified the area east of Squamish for old and large Douglas-fir. Much of the area had recently been logged but a few large trees remained standing at the edges of the cut block. Additional old and large Douglas-fir remain in the area but none of this area is reserved from logging. It is not known how many old and large Douglas-fir will remain after logging is completed in the area.

No tree ages were obtained from this location. Some of the trees seen from the air had dead tops (Figure 20), but they did not have the flattened crowns of those in the Elaho and Upper Squamish River valleys, described in earier sections. Samples of the trees on the ridges at Ring Creek would

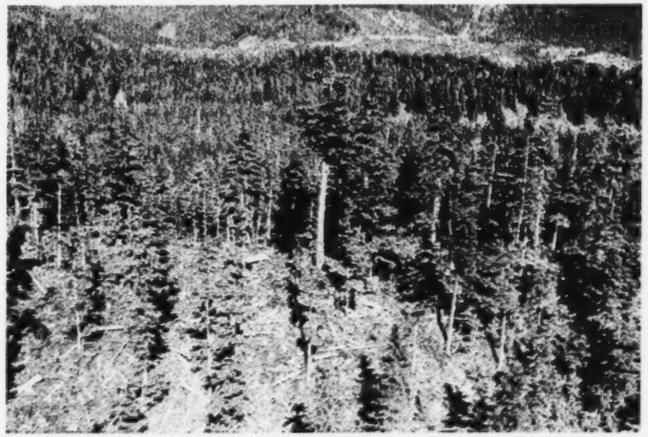

Figure 20. Photograph of old and large Douglas-fir at the Ring Creek logging site, near Squamish, British Columbia.

be ideal for dendrochronological work, since these sites would experience moisture stress during dry years (Stokes and Smiley, 1968).

The area that was photographed is mapped as CWHdm. It is in the Southern Pacific Ranges Ecosection. It is likely that the upper slopes and ridge tops belong to the FdHw – Salal site series (the driest sites would be FdPl – Cladina). Old and large Douglas-fir were seen from the air on these sites. Old and large Douglas-fir were also noted on middle-slope positions, which would be other site series. In general, this area appears to be comparable in terms of site series to the area at Brohm Lake. However, the sites are not comparable to those in the Elaho and Upper Squamish River valleys, described in earlier sections.

3.3.7 Showh Lakes

The plot at Showh Lakes is a Forest Service recreation trail/site. It was identified for old and large Redcedar by BCFS staff. At this time the site is a map notation (a BC Forest Service internal designation). In the future it may be designated as an interpretive forest sites or assigned some other reserve status under the *FPC Section 6(1).* A trail (Figure 21) which begins near the logging road to Showh Lakes takes hikers through a group of old and large Redcedar.

Figure 21. Photograph of Showh Lakes recreation trail at the site of old and large Redcedar, near Whistler, British Columbia.

The Redcedar of the Showh Lakes site could not be sampled with the long increment corer because it was rotten inside. The outer hull of a Redcedar tree that had fallen and been cut to allow hikers easy access, was 588 years old in 19.4 cm. A total age for the downed tree was not estimated because of the large relative amount of rotten core relative to sound perimeter (diameter at the cut was 120 cm).

A Douglas-fir near the group of Redcedar, but upslope of the wet area, was sampled with the long increment corer. It had dry rot inside. Thus, the increment core broke into dozens of pieces as it was extracted from the corer, making reconstruction necessary and counting time consuming. The count was 640 years and the total age of the tree was estimated to be 685 years.

One of the larger Redcedar in the group at Showh Lakes was 46 m tall. Its diameter (taken at 1.9 m due to a second bole below that) was 280 cm (Figure 22). The Douglas-fir was 33 m tall to a broken top. It had a diameter of 132 cm.

The Showh Lakes area is in the CWHms1 and the Eastern Pacific Ranges Ecosection. It should be noted that the site is at 1010 m, i.e. at the upper

Figure 22.Photograph of old and large Redcedar at Showh Lakes recreation trail, near Whistler, British Columbia.

elevations of the variant, near the Mountain Hemlock zone. The plot with the Redcedar is identified as belonging to the BaCw – Devil's Club site series in an old forest structural stage. The Redcedar are in a locally wet pocket-shaped area created by the localized widening of a small stream.

The site of the Douglas-fir above the Redcedar was not sampled but it is not the same site series. (The site of the Douglas-fir is drier in SMR and poorer in SNR than the Redcedar site).

Redcedar is the dominant tree of the area, accompanied by Amabilis Fir and Western Hemlock. The well developed shrub layer is dominated by Devil's Club. One-leaved Foamflower is the most common of a number of herbs in the moderately well developed herb layer. There are almost no mosses on the site.

Surrounded by intact, original forest, the area of Redcedar is interior forest. Logging plans for this area were not checked but it is not reserved from logging except for the recreation site/trail.

The Redcedar trees at this site are comparable to Redcedar trees on similar sites in the Elaho and Upper Squamish River valleys. The only comparable site series that was sampled in this project is at the 381 cm stump in the Upper Squamish River valley, described in an earlier section.

It is possible that the Redcedar at Grizzly Grove, which was not sampled in this project, are also similar in terms of tree characteristics and site.

3.3 Parks

Four areas in parks were identified for sampling by BCFS staff. Of these, the Douglas-fir in Birkenhead Park could not be viewed due to a lack of time for field sampling, while the Douglas-fir at Glacier Lake were only examined and photographed from a helicopter. Douglas-fir in Cheakamus Lake, Clendinning, and Upper Lillooet parks were measured, sites were sampled and photographs were taken. One increment core, to determine tree age of a Douglas-fir, was taken in error in Upper Lillooet Park, but no other increment cores were taken because this may lead to damage of the trees due to entry into the hole, created by the borer, of insects or decay fungi or both.

3.3.1 Cheakamus Lake

Along the trail into the Cheakamus Lake area of Garibaldi Park, near the parking lot at the trailhead, a logged area has a few trees still standing (Figure 23). Large Douglas-fir stumps are along the trail. A small stand of Douglas-fir was sampled at the location where the trail enters uncut forest.

Figure 23. Photograph of a few old and large Douglas-fir among young forest in Garibaldi Park, near the trailhead to Cheakamus Lake.

Even if the trees of the stand could have been cored the results would not have been conclusive because the corer would not have reached the centre of the trees due to their large diameters. A Douglas-fir stump above the

trail, near the parking lot, was burned and cracked at the surface, but it was possible, with some difficulty, to count an age of 642 years. The diameter of the stump was 112 cm. A downed tree in the plot was cut during trail clearing. This tree had no bark remaining so appears to have been dead for many decades. The age counted was 368. This was 4.1 m above the estimated germination point. The diameter at the counted face was 83 cm. Based on their characteristics and the age information, it is likely that the trees still standing at this site are over 600 years old.

Large Douglas-fir at the Cheakamus Lake site were 60 and 41 m tall with diameters of 149 and 167 cm (Figure 24), respectively. The shorter tree had been broken off. Trees had flattened tops.

The site at Cheakamus Lake is in the CWHms1 and the Eastern Pacific Ranges Ecosection. The plot sampled belongs to the HwBa – Queen's Cup in an old forest structural stage.

Redcedar, Western Hemlock and a minor amount of Amabilis Fir were present in the tree layer in addition to the dominant Douglas-fir at the sample site. The shrub layer cover was not well developed. It was

Figure 24. Photograph of one of the old and large Douglas-fir sampled in Garibaldi Park, near the trailhead to Cheakamus Lake, British Columbia.

dominated by tree regeneration and Falsebox. The moss layer also had limited cover, which was dominated by *Dicranum fusescens*.

One side of the stand of Douglas-fir sampled is at a natural edge created by an avalanche chute. There is no interior forest near it. The Douglas-fir component in the area is not large, so the amount of Douglas-fir type with interior forest condition has not been analyzed in this project.

This area is somewhat comparable, from an individual tree and a site perspective, to the stands of old and large Douglas-fir in the Elaho and Upper Squamish River valleys. In particular, the old and large trees are estimated to be hundreds of years younger at this site but some have broken tops, widened crowns, large diameters, and deeply furrowed bark, like those in the Elaho and Upper Squamish River valleys. This site is in the same biogeoclimatic unit and ecosection. It has a slightly higher SMR (5) but a similar SNR (medium) compared to those in the Elaho and Upper Squamish River valleys. The discontinuous distribution of Douglas-fir at this site is a major difference from the stands in the Elaho. In this way the area is similar to the remnant Douglas-fir patch in the Upper Squamish River valley.

3.3.2 Clendinning

A component of the area that was proposed for protection during the PAS process for the lower mainland, was designated in 1999 as Clendinning Park (in Bill 86 – the Park Ammendment Act). The park includes the Clendinning Creek watershed and a small part of the Elaho River watershed. Prior to being designated as a provincial park almost all of the area was part of TFL 38.

Most of the park is alpine and subalpine. A small area of original submontane forest, frequently broken by avalanche chutes, is in the watershed of the Clendinning River. The majority of submontane forest is in the Elaho watershed. The park also has some excellent wetlands in the Elaho River valley.

Ages for the trees could not be determined since they were too large to core. However, based on the proximity to the stands on the other side of the Elaho River and their comparable characteristics, they are estimated to be of a similar age, i.e. over 1000 years old.

Two sites were sampled in the park. In addition, the diameters of a number of trees were measured in a transect between the samples.

At one sample plot Douglas-fir was 42 m tall and had a diameter of 237 cm. At a second plot the Douglas-fir were 44 and 36 m tall, with diameters of 201 (Figure 25) and 179 cm, respectively. All the trees sampled had very similar characteristics (Figure 26) to those on the other side of the Elaho River and those in the patch in the Upper Squamish River valley.

Douglas-fir measured between the samples also had similar diameters to those listed above.

The area is in the CWHms1 and the Eastern Pacific Ranges Ecosection. The two plots sampled in the area represent the HwBa – step moss site series in an old forest structural stage. This is the zonal site series for the CWHms1. The SMR is 4 and the SNR ranges between poor and medium.

In both plots, Douglas-fir was the tallest species in the tree layer. Redcedar was also a prominent species in this layer. Western Hemlock and Amabilis Fir were also present. In one plot the moderately well developed shrub layer was dominated by: False Azalea, Oval-leaved Blueberry, and Red Huckleberry. In the other plot the shrub layer was more dense and included Alaskan Blueberry as a major species in addition to those listed above. The herb layer in both plots was sparse, with Twinflower (one plot) and Prince's-pine (other plot) as the primary species. The moss layer was moderately well developed in one plot with *Hylocomium splendens*, *Pleurozium schreberi*, and *Rhytidiopsis robusta* as major contributors to the cover. In a second plot the moss layer was well developed but *Rhytidiadelphus loreus* was a major species and *Pleurozium schreberi* was not.

Figure 25. Photograph of bole of old and large Douglas-fir in Clendinning Provincial Park, British Columbia.

Figure 26. Photograph of Douglas-fir bole and crown in Clendinning Provincial Park, British Columbia.

Site characteristics of this area are comparable to those on the other side of the Elaho River but not comparable to the patch in the Upper Squamish River valley. The big difference between this area and the Douglas-fir Loop Trail area, on the other side of the Elaho River, is the old and large Douglas-fir in the park are sparsely distributed in heterogeneous terrain while they are densely distributed in relatively homogeneous terrain in the Douglas-fir Loop Trail area. Many rock outcrops and bluffs occur in the park area.

At the landscape level, the area has a similar history and dynamics as the area of the Douglas-fir Loop Trail. Interior forest is present, but natural edges are created by the rock outcrops and bluffs. It would take a more detailed analysis than is possible in this project to compare the landscape level characteristics of components of this area to that of the Douglas-fir Loop Trail. It may be possible to maintain natural disturbance processes in the park but fire control will probably be maintained to avoid the chance of spread to industrial forests of TFL38.

3.3.3 Glacier Lake

Old and large Douglas-fir were reported to be in the Glacier Lake area of Garibaldi Park by BCFS staff. It was not possible to sample the area because of lack of time and resources. The area was viewed from a helicopter and photographed. It was not possible to land the helicopter near the stand of Douglas-fir because there were no landing areas nearby. The area that was photographed is mapped as CWHds1. It is in the Eastern Pacific Ranges Ecosection.

Old and large Douglas-fir were seen from the air on the slopes above Glacier Lake. The largest trees appeared to be on a fluvial fan of a creek that flows into the lake (Figure 27), and along the west side of the lake (the east side is mostly logged).

Figure 27. Photograph of old and large Douglas-fir near the shore of Glacier Lake, Garibaldi Park, British Columbia.

Most of the Douglas-fir at this location appear to be vigorous as indicated by full, intact, spire-shaped crowns. Thus, they do not resemble the old and large Douglas-fir in the Elaho and Upper Squamish River valleys, described in earlier sections.

This area appears to be comparable, in terms of biogeoclimatic variant, to the area at the Mine Site and Port Douglas, both near the mouth of the Lillooet River; Deminger Trail, along the Upper Squamish River; and the site at km 27, Upper Lillooet River valley. However, the biogeoclimatic variant is different from that in the Elaho and upper Upper Squamish River valleys, described in earlier sections.

3.3.4 Upper Lillooet

Old and large Douglas-fir were reported to be in Upper Lillooet Park by BCFS staff. This area represents a part of the area that was proposed for protection during the PAS process for the lower mainland. In literature associated with the proposal a 300 ha area of Douglas-fir is described to be present in this area. It is not known if the area examined in this project is part of that area or not.

A site that had old and large Douglas-fir in this park was examined (Figure 28). An increment core was taken from one Douglas-fir

Figure 28. Photograph of Douglas-fir stand that was sampled in Upper Lillooet Provincial Park, British Columbia.

(Figure 29), a plot was completed and photographs were taken.

Based on the years counted in the increment core (328 years for 29.0 cm – the long increment corer had not been obtained yet) plus a correction of between 175-275 years to the centre, since it was not reached in the 186 cm-diameter tree, yielded an estimated age of 500 to 600 years. The tree was 51 m tall. It had an intact, live top. Another tree was measured near this plot, it had a diameter of 150 cm, a fork 20 m up from the base and was on the edge of a gully. The height was not measured.

The site examined in Upper Lillooet Park is in the CWHms1 and the Eastern Pacific Ranges Ecosection. The site series is HwBa – Queen's Cup in old forest structural stage. It has a SMR of 5 and SNR of poor. Although the site is in a lower-slope topographic location which would

suggest that groundwater might be near the surface, this was not the case because of the sandy soil with a high coarse fragment content. The soil is derived from pumice.

Douglas-fir was by far the most predominant species in the tree layer of the plot. A prism sweep (BAF 13) included 13 large Douglas-fir for a basal area of 169m^2. This indicates a very high density of old and large trees! Amabilis Fir and Western Hemlock were minor species in the lower canopy of this site. The moderately dense shrub layer was dominated by

Figure 29. Photograph of Douglas-fir that was sampled in Upper Lillooet River Provincial Park, British Columbia.

Douglas Maple and Black Huckleberry. Rosy Twisted-stalk had the greatest cover in the sparse herb layer, followed by One-leaved Foamflower and Queen's Cup. There were no mosses in the plot.

Tree ages of the stand sampled in Upper Lillooet Park are estimated to be several centuries younger than those of: Clendinning Park, the Douglas-fir Loop Trail, and the patch in the Upper Squamish River valley at the 46 mile location along the logging road.

On the other hand, this area is in the same biogeoclimatic variant and ecosection as the sites at Clendinning Park, Douglas-fir Loop Trail and Upper Squamish valley. It is probable that the site series is present in Clendinning Park, but the unit was not sampled during the work there. The site series is not comparable to the Douglas-fir Loop Trail sites that were identified. However, it may be present in the area, but as a minor component.

The primary difference between this area and the Douglas-fir Loop Trail area, on the other side of the Elaho River, is the old and large Douglas-fir in the park are located on a ridge that has avalanche gullies on both sides while they are less dense but evenly distributed across a larger area of relatively homogeneous terrain in the Douglas-fir Loop Trail area.

Interior forest is absent or limited at the site examined due to natural edges, created by the avalanche gullies. It would take a more detailed analysis to compare the landscape level characteristics of components of this area to that of the Douglas-fir Loop Trail. Natural processes may be possible in the park but fire control will probably have to be maintained to avoid the chance of spread to industrial forests of the Upper Lillooet River valley.

3.4 Summary of all areas

Table 3 is a compilation of the counted or estimated ages and mensurational statistics of the trees sampled in this project.

Accurately determining the ages of the largest standing trees in this project was impossible. At the beginning of the project only a short corer was available. Shortly after the start of the project a longer coring bit was used but was still not long enough to reach the centre of the larger trees. Also, many of the larger trees remain today because they were not cut during the first pass of logging due to some defect, often rot. This made it impossible to obtain complete partial cores in some cases. An attempt at a sample from a rotted tree usually fouled the corer which had to be cleared with a long-shafted drill. Slightly larger corers exist, but were also not available

Table 3. Summary of estimated ages of sampled old Douglas-fir and Western Redcedar in the Squamish Forest District, British Columbia.

Location	Species	Counted or Estimated Age (years)	Diamet-er (cm)	Height (metres)	Top
Deminger Trail	Fd	329-333	164	74	intact
Douglas-fir Loop Trail	Fd	ca1000	193	41	broken off
Douglas-fir Loop Trail	Fd	ca1000	186	38	broken off
Elaho Giant	Fd	ca1000	270	47.5	broken off
Squamish Valley 46 mile	Cw	unknown	237	52	dead
Squamish Valley 46 mile	Fd	ca 1000	202	56	dead
Ring Creek	Fd	unknown	unknown	unknown	unknown
Port Douglas	Fd	ca 210	163	69	dead
Port Douglas	Cw	unknown	336	44	dead
Mine Site above road	Fd	ca 400	unknown	27	unknown
Mine Site below road	Fd	290	98	41	intact
Furry Ck	Fd	unknown	210	67	dead
Lillooet Valley 27 km	Fd	ca 550	143	49	intact
Brohm Lake	Fd	366	106	39	intact
Brohm Lake	Fd	ca 300	129	61	intact
Brohm Lake	Fd	ca 400	175	59	unknown
Showh Lake	Cw	over 600	280	46	unknown
Showh Lake	Fd	ca 685	132	33	broken off
Clendinning Park	Cw	unknown	228	unknown	unknown
Clendinning Park	Fd	ca 1000?	237	42	broken off
Clendinning Park	Fd	ca 1000?	201	44	broken off
Clendinning Park	Fd	ca 1000	179	36	broken off
Upper Lillooet Park	Fd	500-600	186	51	intact?
Cheakamus L	Fd	over ca 650	149-167	60-51	broken off

ca = estimated based on data from stumps or partial cores

on short notice. The longest available in the Pacific Northwest is thought to be 86cm. Information that a 96.5cm corer was available as a custom order from Haglof® proved to be incorrect.

Coring of very old trees is intrusive and may lead to introduction of pathogens. The potential damage to a tree due to coring must be weighed against the value of the information. Research should be carried out to determine the long-term effects, if any, of coring very old trees.

Table 4 provides a summary of the ecological classification data.

Table 4. Site identification of plots with old and large Douglas-fir and Redcedar in the Squamish Forest District, British Columbia

Biogeo-climatic Subzone/ Variant	Site Series No./Name	Name of Area	Site Modifier	Structural Stage
CWHdm	06 HwCw - Deer fern	Furry Creek		immature forest
CWHdm	03 FdHw – Salal	Brohm Lake		old forest*
CWHdm	06 HwCw – Deer fern	Brohm Lake		old forest
CWHdm	not identified	Ring Creek	not identified	wildlife trees and old forest
CWHds1	05 Cw - Solomon's-seal	Deminger Trail	none	old forest
CWHds1	02 FdPl – Kinnikinnick	Mine Site	humocky, warm	old forest
CWHds1	07 Cw - Devil's club	Port Douglas	active floodplain	mature forest
CWHds1	01 HwFd - Cat's-tail moss	Lillooet Valley 27 km	terrace	old forest
CWHms1	01 HwBa - Step moss	Douglas-fir Loop Trail	none	old forest
CWHms1	not identified	Elaho Giant	not identified	wildlife tree patch
CWHms1	not identified	Grizzly Grove	not identified	wildlife tree patch
CWHms1	06 BaCw – Devil's Club	Squamish River 46 mile Cw	coarse	old forest
CWHms1	not identified	Squamish River 46 mile Fd	not identified	old forest
CWHms1	06 BaCw – Devil's Club	Showh Lakes		old forest
CWHms1	01 HwBa - Step moss	Clendinning Park	j	old forest
CWHms1	05 HwBa - Queen's cup	Upper Lillooet Park		old forest
CWHms1	05 HwBa - Queen's cup	Cheakamus Lake		old forest

* underburned with immature forest regenerating

Oldest and Largest Trees

The Douglas-fir and Reucedar measured during this project in the Squamish Forest District, including those at the site of the Douglas-fir Loop Trail, are not record age, diameter or height as compared to those in British Columbia and northwestern Washington (Table 5, 6). The data on ages for record sized trees are generally not available. A Douglas-fir that was 1350 years old has been documented in the Cowichan Valley (Stoltmann, 1991, p116). Also, according to Stoltmann, 1999, p 115: "A small stand of old ancient Douglas-fir trees on the western side of Waterloo Mountain in MacMillan Bloedel's Shawnigan Division is

Table 5. Data for largest Douglas-fir from Squamish Forest District compared to record-sized trees from other areas.

General Location	Estimated Age (years)	Diameter (cm)	Height (metres)	Source
Elaho Giant	over 1000	270	47.5	this project
Deminger Trail	329-333	164	73.1	this project
Port Renfrew (east of)	unknown	399.5	73.8	(Stoltmann, 1991)
Strathcona Park – Puntledge R	unknown	186.8	82.93	(Stoltmann, 1991, p 180)
USA	unknown	354.1	100	http://www.odf.state.or.us/BIGTREES/

Table 6. Data for large Western Redcedar from Squamish Forest District compared to record-sized trees from other areas.

General Location	Estimated Age (years)	Diameter (cm)	Height (metres,feet)	Source
Squamish Valley 46 mile	unknown	381 stump	unknown	this project
Pacific Rim National Park – Cheewhat L	ca 1400	604.2	59.15	(Stoltmann, 1991)
Olympic National Park	unknown	615	48	http://www.odf.state.or.us/BIGTREES/
Forks WA	unknown	592	54	http://www.odf.state.or.us/BIGTREES/

ca = estimated

believed to contain the oldest know trees of this species in Canada." These trees are scattered among a stand of younger Redcedar and Western Hemlock. One of these trees was 1340 years old when it fell in the winter of 1985/86. It was 1.9m diameter and 45m tall with a broken top. Thus, the Douglas-fir ages estimated in this project are not the oldest recorded. However, it is possible that individual Douglas-fir trees in the areas of the Douglas-fir Loop Trail, Clendinning Park, and Upper Squamish Valley have trees that are older than the ages counted from stumps in this project.

The largest Douglas-fir trees reported in BC include Port Renfrew and Puntledge River, according to the big tree record kept by the CDC (initiated by Randy Stoltmann). The Port Renfrew tree grows on the eastern slopes above the San Juan River. The "Red Creek Tree" was estimated to be less than 1000 years old (Stoltmann, 1991, p 110). A 10 ha reserve has reportedly been established around the tree by Fletcher Challenge Canada Ltd. The forest around the tree is reported to be natural western hemlock. The tree is thought to have germinated on a landslide.

Puntledge River, in Strathcona Provincial Park is reported to contain the tallest Douglas-fir in BC (Table 6).

The largest Redcedar recorded in British Columbia is off the Rosander Mainline near Cheewhat Lake, east of Nitinat Lake, in Pacific Rim National Park. It is reported to be 6 m in diameter and 59 m tall (Table 6). A Redcedar tree near this one is estimated to be 1400 years old (p 131).

4 CONCLUSIONS

1. Except for the upper Elaho area, (includes Clendinning Park and the Douglas-fir Loop Trail area, no areas were found in the Squamish Forest District to have Douglas-fir that are over 1000 years old
2. Some areas of the Squamish Forest District have Redcedar that may be over 1000 years old but it is not possible to determine accurate ages due to rot in the centers of the trees
3. The area of the upper Elaho that has the Douglas-fir Loop Trail, marked by Western Canada Wilderness Committee volunteers, has a concentration of trees (over 40) that are probably over 1000 years old.
4. It is possible that areas with a similar high density of trees could be found in Clendinning Provincial Park but they were not found in this study during an aerial survey nor ground sampling. (Clendinning Provincial Park contains a large number of trees that have features in common with the old trees in the area of the Lava Creek trail, but they are generally more scattered)
5. Most of the areas with old Douglas-fir in the Squamish Forest District have trees that are 3 to 4 centuries old on drier, rocky sites. The landscape matrix in the areas that contain the old trees is generally young forest.
6. Old trees within the forest matrix that were not cut in the early logging were generally left because they were not merchantable or inaccessable. Often they have rot in them or they lean.
7. Succession in most of the sites with old Douglas-fir is to Western Hemlock and Redcedar
8. The remaining areas with old trees are mostly not reserved or their area is small.
9. The concentrations of old and large Douglas-fir trees in the upper Elaho Valley referred to as the Douglas-fir loop trail is considered unique and should be managed for research and conservation..
10. Additional areas of old and large Douglas-fir should be sought in the Squamish Forest District and be reserved from cutting as part of biodiversity conservation.

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APPENDIX 1 ORIGINAL LIST OF LARGE DOUGLAS-FIR AND WESTERN REDCEDAR LOCATIONS IN THE SQUAMISH FOREST DISTRICT (SEPTEMBER 1, 1999)

Location	Tree Species*	Source of Information	Priority to Sample	Number on Original Map	Sampled?
Furry Creek	Fd, Cw	Jim Aseltine (local logger) Al Hoyrup	yes	1	yes
Brohm Lake	Fd	John Crooks	yes	2	yes
Showh Lakes	Cw	Dale Feltrin	yes	3	yes
Lillooet Valley 27 km	Fd	Andre Germain	yes	4	yes
Upper Lillooet Park	Fd	Andre Germain	yes	5	yes
Grizzly Grove	Fd	Stu McDonald	yes	6	no
Clendinning Park	Fd, Cw	Stu McDonald	yes	7	yes
Cabbage Patch (approx. 10 ha left uncut)	Fd	Bob Lawrence Keith Magee	yes	8	no
Squamish Valley West Side	Fd,Cw	Stu McDonald	no	9	no
Port Douglas	Cw	Bob Lawrence	yes	10	yes
Douglas Creek	Cw	Keith Magee	no	11	no
Squamish Valley 46 mile	Cw	Stu McDonald	yes	12	yes
Squamish Valley 46 mile	Fd	Stu McDonald	yes	13	yes
Cheakamus Lake	Cw	Dale Feltrin	yes	14	yes
Glacier Lake, in park and adjacent to lake	Fd	Bob Lawrence	no	15	no
Sockeye Creek (mouth)	Fd	Bob Lawrence	no	16	no
Indian River (mouth), West Side (near last block)	Fd	Phil Sondrup	no	17	no
Indian River/Stawamus River heads adjacent to cut blocks	Fd	Phil Sondrup	no	18	no
Ring Creek (above "T" Block)	Fd	Yves LaForet	yes	19	no
Deminger Trail	Fd	Stu McDonald	yes	20	yes
Meagher Creek (cut trees on ground)	Fd	John Crooks	no	21	no

*Fd = Douglas-fir, Cw = Western Redcedar

APPENDIX 2 KEY TO SAMPLES FOR REPORTED LARGE DOUGLAS-FIR AND WESTERN REDCEDAR IN THE SQUAMISH FOREST DISTRICT

Area or name	Plot numbers	Number on original map
Brohm Lake	Sep14-2, Sep26-1	2
Cheakamus Lake	Sep9-2	14
Clendinning Park	Sep15-1, Sep15-2	7
Deminger Trail	Sep7-1	20
Douglas-fir Loop Trail	9806601, Sep13-2	
Elaho Giant	diameter and notes only	
Elaho Valley burn site	Sep17-1	
Elaho Valley retention cut	Sep10-1, Sep10-2	
Furry Creek	Sep14-1	1
Glacier Lake	photos and aerial observations only	15
Lillooet Valley 27 km	Sep3-1	4
Port Douglas Cw	Sep8-1, Sep8-2	10
Port Douglas mine site	Sep8-3	
Ring Creek (above "T" Block)	photos and aerial observations only	19
Showh Lakes	Sep9-1	3
Squamish Valley Cw 46 mile	Sep2-1	12
Squamish Valley Fd 46 mile	Sep2-2	13
Upper Lillooet Park	Sep3-2	5

From Appendix 1.

APPENDIX 3 SCIENTIFIC NAMES OF SPECIES

Common name	Scientific name
Alaskan Blueberry	*Vaccinium alaskaense*
Amabilis Fir	*Abies amabilis*
Bigleaf Maple	*Acer macrophyllum*
Black Huckleberry	*Vaccinium membranaceum*
Bunchberry	*Cornus canadensis*
Cat's Tail Moss	*Rhytidiopsis robusta*
Deer Fern	*Blechnum spicant*
Devil's Club	*Oplopananx horridus*
Douglas Maple	*Acer glabrum*
Douglas-fir (Fd)	*Pseudotsuga menziezii var. menziesii*
False Azalea	*Menziesia ferruginea*
Falsebox	*Pachistima myrsinites*
Fireweed	*Epilobium angustifolium*
Hooker's Fairybells	*Disporum hookeri*
Kinnikinnick	*Arctostaphylos uva-ursi*
Mountain Hemlock	*Tsuga mertensiana*
One-leaved Foamflower	*Tiarella trifoliata var. unifoliata*
Oval-leaved Blueberry	*Vaccinium ovalifolium*
Prince's-pine	*Chimaphila umbellata*
Queen's Cup	*Clintonia uniflora*
Red Alder	*Alnus rubra*
Red Huckleberry	*Vaccinium parvifolium*
Rosy Twistedstalk	*Streptopus roseus*
Salal	*Gaultheria shallon*
Shore Pine	*Pinus contorta var. contorta*
Sitka Alder	*Alnus crispa ssp. sinuata*
Solomon's-seal	*Smilacina stellata*
Step Moss	*Hylocomium splendens*
Subalpine Fir	*Abies lasiocarpa*
Twinflower	*Linnaea borealis*
Western hemlock	*Tsuga heterophylla*
Western Redcedar	*Thuja plicata*
Western Yew	*Taxus brevifolia*
Yellow-cedar	*Chamaecyparis nootkatensis*